Send Orders for Reprints to reprints@benthamscience.ae

The Open Sports Science Journal, 2014, *7*, 183-197

Open Access

Performance Analysis During the 2014 FIFA World Cup Qualification

Martin Flégl*

Department of Systems Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Czech Republic

Abstract: This article analyzes the performance of the national football teams during the 2014 FIFA World Cup qualification. The sample consists of 31 qualified national teams to the final tournament in Brazil. The analysis uses Data Envelopment Analysis (DEA) methodology and is carried out for the whole qualification period between June 2011 and November 2013. Each national team is evaluated according to a number of played matches, used players, qualification group quality, obtained points, and score. The results show that only 12.9% teams reached the performance of 100%. The reasons of low performances mainly depend on teams´ qualities either in each qualification zone or in each qualification group. In addition, a sensitivity analysis is used to confirm the adequate structure of the DEA model.

Keywords: Data envelopment analysis, football, performance, qualification, sensitivity analysis.

INTRODUCTION

FIFA World Cup is one of the biggest and the most known event in the World. More than 200 countries participated in the current qualification and 31 teams qualified to the final tournament (the 32nd team is Brazil as the host country). The history of the FIFA World Cups became in 1930 when the first FIFA World Cup took place in Uruguay. The first tournament hosted only 13 participants and 18 matches were played "(Table **1**)". FIFA World Cup put a 13-year stop before the Second World War. After this period in the year 1950, the tournament rapidly advanced to its undoubted status as one of the greatest single sporting events. Since 1950 until 1978, the final tournament hosted 16 participant teams. The number of participants was enlarged up to 24 for the 1982 FIFA World Cup in Spain. The last enlargement observed in 1998 and since the 1998 FIFA World Cup in France the number of participants is 32. The number of matches per World Cup has increased from 18 in its origin to 64 matches nowadays.

Since 1930, only eight different winners have won the trophy. Spain is the defending champion from the 2010 FIFA World Cup in South Africa. The most successful country is Brazil with 5 World Cup titles. Historically, the most successful teams, beyond Brazil and Spain, are Italy (4 titles), Germany (3 titles), Argentina (1 title), France (1 title), and Uruguay (1 title).

Apart from the huge audience of the 2014 FIFA World Cup in Brazil, all participant teams can expect a high profit. In December 2013, FIFA [1] announced the financial redistribution for teams according to their tournament performance. The total contribution for the participants will be USD 576 million, which represents increase by 37% compared to the previous 2010 FIFA World Cup in South Africa. The winner received USD 35 million, while the runners-up obtained USD 25 million. Those teams that were eliminated in the group stage each received USD 8 million. In addition, each of the 32 qualified teams was granted USD 1.5 million for preparation costs. Moreover, USD 70 million was provided by FIFA via the member associations to the clubs whose players took part in the final tournament as a contribution towards their participation.

FIFA WORLD CUP QUALIFICATION

FIFA World Cup qualification is divided into six geographic zones: Asian Football Confederation (AFC), Confederation of African Football (CAF), Confederation of North[1], Central American and Caribbean Association Football (CONCACAF), South American Football Confederation (CONMEBOL), Oceania Football Confederation (OFC), and Union of European Football Associations (UEFA). The allocation of qualified teams for each confederation is as follows: AFC has 4.5 teams, CAF 5.0, CONCACAF 3.5, CONMEBOL 4.5, OFC 0.5 and UEFA 13.0 (Fig. **1**). The half spots indicate international home-and-away play-off matches between AFC-CONMEBOL and CONCACAF-OFC. The last team who will play in the FIFA World Cup is the host country Brazil [2].

The qualification system differs from zone to zone due to the different number of confederation members. The Asian part of the qualification is organized by the *Asian Football*

*Address correspondence to this author at the Department of Systems Engineering, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, Prague 6 – Suchdol, 165 21, Czech Republic; E-mail: martin.flegl@hotmail.com

[1]During the years 1940 and 1990 Germany was divided into the West (German Federal Republic) and the East (German Democratic Republic) Germany.

1875-399X/14

Table 1. History of FIFA World Cups, 1930-2010.

World Cup Tournament	Teams	Matches	Winner	Second	Third	Fourth
2010 FIFA World Cup South Africa	32	64	Spain	Netherlands	Germany	Uruguay
2006 FIFA World Cup Germany	32	64	Italy	France	Germany	Portugal
2002 FIFA World Cup Korea/Japan	32	64	Brazil	Germany	Turkey	Korea Republic
1998 FIFA World Cup France	32	64	France	Brazil	Croatia	Netherlands
1994 FIFA World Cup USA	24	52	Brazil	Italy	Sweden	Bulgaria
1990 FIFA World Cup Italy	24	52	Germany FR	Argentina	Italy	England
1986 FIFA World Cup Mexico	24	52	Argentina	Germany FR	France	Belgium
1982 FIFA World Cup Spain	24	52	Italy	Germany FR	Poland	France
1978 FIFA World Cup Argentina	16	38	Argentina	Netherlands	Brazil	Italy
1974 FIFA World Cup Germany	16	38	Germany FR	Netherlands	Poland	Brazil
1970 FIFA World Cup Mexico	16	32	Brazil	Italy	Germany FR	Uruguay
1966 FIFA World Cup England	16	32	England	Germany FR	Portugal	Soviet Union
1962 FIFA World Cup Chile	16	32	Brazil	Czechoslovakia	Chile	Yugoslavia
1958 FIFA World Cup Sweden	16	35	Brazil	Sweden	France	Germany FR
1954 FIFA World Cup Switzerland	16	26	Germany FR	Hungary	Austria	Uruguay
1950 FIFA World Cup Brazil	13	22	Uruguay	Brazil	Sweden	Spain
1938 FIFA World Cup France	15	18	Italy	Hungary	Brazil	Sweden
1934 FIFA World Cup Italy	16	17	Italy	Czechoslovakia	Germany	Austria
1930 FIFA World Cup Uruguay	13	18	Uruguay	Argentina	USA	Yugoslavia

Note: Germany FR stands for German Federal Republic, Source: www.fifa.com

Confederation (AFC). The AFC had 46 member associations, but only 43 members participated in 2014 FIFA World Cup qualification (Bhutan, Brunei Darussalam and Guam did not register for the competition). All qualification rounds took place between June 2011 and September 2013 (see [3] for the qualification format). African qualification zone is organized by the *Confederation of African Football* (CAF). CAF had 53 association members in the year 2011, but only 52 members participated in the qualification (Mauritania did not register for the competition). African took place between November 2011 and November 2013 [4].

The CONCACAF organizes qualification in the North, Central American and Caribbean. The CONCACAF has 35 association members and all of them participated in the qualification. The qualification took place between June 2012 and October 2013 [5]. The *South American Football Confederation* (CONMEBOL) organized qualification in the South America. Due to only 9 teams that participated in the qualification, the qualification had only one round and all matches took place from October 2011 to October 2013 [6].

Oceania zone, organized by the *Oceania Football Confederation (OFC)*, is the smallest zone in the FIFA World Cup qualification system. OFC has only 11 association members (Australia left OFC zone in the year 2006 and joined the AFC zone due to a higher quality of the Asian teams and better chance to qualify to the FIFA World Cups - more spots for Asian zone.) and all participated in the qualification. The qualification took place from November 2011 to March 2013 [7].

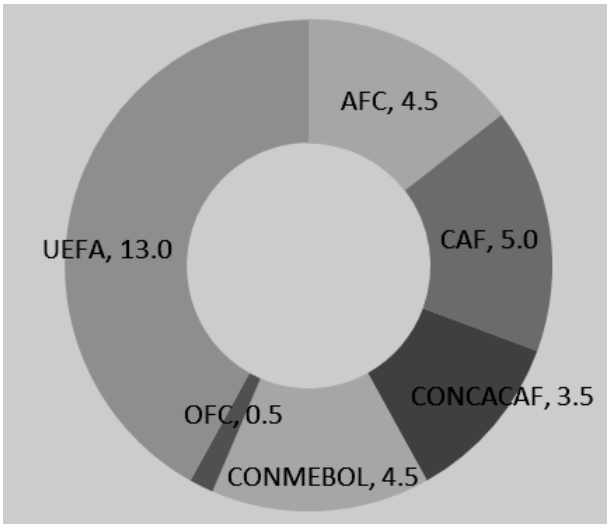

Fig. (1). The allocation of qualified teams for each confederation.

The European part of the qualification is organized by the *Union of European Football Associations (UEFA)*. The UEFA has currently 54 association members, but only 53 members participated in the qualification (54^{th} member Gibraltar joined the UEFA association in the year 2013. Therefore, Gibraltar was not included in the preliminary draw in July 2011.). All qualification matches took place between September 2012 and October 2013 [8].

MEASURING EFFICIENCY AND PERFORMANCE IN FOOTBALL

Football performance evaluation is a much discussed issue, as many other businesses and industrial areas. Examples of football performance evaluation are [9-12]. Moreover, Tiedemann *et al.* [13] focused on a performance of football players instead of the whole clubs. Many of these authors used the Data Envelopment Analysis for performance evaluation. DEA models differ according to their inputs/outputs structures. For example, Boscá *et al.* [14] analyzed technical efficiency of Italian and Spanish football. Their contribution assessed the offensive and defensive aspect of the game between the seasons 2000/2001 and 2002/2003. These authors used inputs and outputs such as goals scored, shots on the goal, attacking plays, and possessions.

Barros & Leach [15] evaluated performance of the English Premier League football clubs between the season 1998/1999 and 2002/2003. Football clubs were measured using input indicators such as number of players, wages, net assets, and stadium facilities expenditures. Output indicators were points obtained in the season, attendance, and turnover. Haas [16] used the Data Envelopment Analysis for assessing technical efficiency in the US Major League Soccer. Twelve US Major League Soccer teams were assessed according to players' and coaches' wage bills, number of gained points, absolute number of spectators at the stadiums, and clubs' revenues.

As a result of the discussed papers above, inputs and outputs of the DEA model for football evaluation usually have financial and non-financial characters. Non-financial inputs are usually number of players, or stadium utilization rate. On the other hand, financial inputs are wages of players or coaches, net assets and stadium facilities expenditure. Further, non-financial outputs for the DEA model are obtained points by each football club in the season or attendance at the stadiums. Financial outputs are then clubs' turnovers, income from merchandising and tickets. The advantage of using DEA in performance analysis lies in the ability of using different variety of indicators. Moreover, DEA provides information about efficient behavior for inefficient teams, players, clubs, etc.

Performance analysis can also focuses on prediction of football results. Saumik and Ronita [17] analysed FIFA World Cup tournaments from 1994 to 2006 according to a possibility of match predications. These predictions were based on the official FIFA Ranking and count into account number of goals score by each team, number of yellow and red cards.

The main objective of this paper is to analyze the performance of the national football teams that qualified to the 2014 FIFA World Cup in Brazil. The partial objective is to find out the reasons of the different performance within the qualification zones and in the whole qualification. This performance is assessed according to the following indicators: used players, played matches, and opponent teams that each team faced in the FIFA World Cup qualification.

MATERIALS AND METHODS

Sample

The analysis includes all qualified national football teams to 2014 FIFA World Cup in Brazil. More specifically, sample consists of 31 national teams (Table **3**); from the Asian zone (AFC) Australia, Iran, Japan, and Korea Republic; from the African zone (CAF) Algeria, Cameroon, Côte d'Ivoire, Ghana, and Nigeria; from the North, Central America and Caribbean zone (CONCACAF) Costa Rica, Honduras, Mexico, and USA; from the South America zone (CONMEBOL) Argentina, Chile, Colombia, Ecuador, and Uruguay; and, finally, from the Europe zone (UEFA) Belgium, Bosnia-Herzegovina, Croatia, England, France, Germany, Greece, Italy, Netherlands, Portugal, Russia, Spain, and Switzerland. The sample contains no team from the Oceania zone (OFC), because New Zealand lost the intercontinental play-off against Mexico.

For the analysis we use the data from the official FIFA website (the FIFA ranking [18] and qualification statistics), and the data from official websites of each football confederation. Collected data refer to the period of the FIFA World Cup qualification, i.e. from June 2011 to November 2013 (Table **3**).

Data Envelopment Analysis

The Data envelopment analysis (DEA) enables to assess various Decision-Making Units (DMUs) with regard to their abilities to cover multiple inputs into multiple outputs [19]. Each DMU can have various amounts of m different inputs to produce s different outputs. If the model supposes constant returns to scale (CRS), the so-called CCR model can be used [20]. The output-oriented CCR model is formulated as follows:

$$\min q = \sum_{i=1}^{m} v_i x_{io} \tag{1}$$

subjected to

$$\sum_{i=1}^{m} v_i x_{ij} - \sum_{r=1}^{s} \mu_r y_{rj} + q_0 \geq 0$$

$$\sum_{r=1}^{s} \mu_r y_{ro} = 1 \tag{2}$$

$$\mu_r, v_i \geq 0 \; \varepsilon > 0$$

where x_{ij} is the amount of input i of DMU_j, y_{rj} is the amount of output r of DMU_j, v_i and μ_r are weights of inputs and outputs, and ε is a so-called non-Archimedian element. DMU is 100% efficient if $q=1$, i.e. there is no other DMU that produces more outputs with the same combination of inputs. On the other hand, DMU is inefficient if $q \geq 1$.

If the model supposes variable return to scales (VRS), the so-called BCC model can be used [21]. The output-oriented BCC model is then formulated similarly as the CCR model, but requires constraint $\sum_{j=1}^{n} \lambda_j = 1$. This added constraint introduces an additional variable μ_0 into the model. This extra variable enables to express variable returns to scale [19].

The scale efficiency (SE) was introduced by Färe *et al.* [22]. For the calculation of the scale efficiency we need efficiency results from both CRS and VRS models. If there is a difference between efficiency scores under the CRS and VRS for a certain DMU, then the difference indicates the scale inefficiency. The scale efficiency is calculated as follows:

$$SE = \frac{CCR\ efficiency}{BCC\ efficiency} \tag{3}$$

If $SE = 1$, then the DMU is scale efficient (inputs and outputs combination is efficient[2] both under the CRS and VRS). If $SE < 1$, then the DMU is scale inefficient. Author used the Efficiency Measurement System (EMS) SW for the calculation of the DEA model [23].

Inputs and Outputs for DEA Model

Before building the performance model, it is important to specify the term performance. The author characterises team´s performance in the 2014 FIFA World Cup qualification as a long-term capability to transform effectively its inputs (players, played matches etc.) to outputs (gained points and score). Thus, a higher performance reaches that team, which uses fewer players and plays against difficult opponents, and, on the other hand gains either more points or reaches better goal difference.

The author chose the structure of the model with regard to the effort to minimize the differences among all qualification zones. Inputs for the Data Envelopment Analysis (DEA) model express the whole qualification process of each team. How many players each team needed for the qualification and how many matches each team played. These criteria enable the comparison with regard to the differences between all qualification zones described above.

- First input PLAYERS refers to a number of players, which each national team used in the qualification matches (Table **2**). According to the DEA principles, better performance has a team that used fewer players and gained more outputs. The number of players differs according to a number of played matches and the length of qualifications (number of rounds). Football rules enable 3 substitutions per a match for a team and this limit is almost always used. However, substitutions are influenced by other aspects such as tactics, development of the match score, injuries etc. From this reason, PLAYERS input is more suitable than a ratio of used players per a match.
- Input PLRTIME expresses a ratio of minutes played each player of the national team during the whole 2014 FIFA World Cup qualification (Table **2**). That national team that used fewer players or/and played more matches, put more pressure to its players. It is important to point out that differences among national teams exist. Football in developed countries with long football traditions (such as England, France, Germany) have more options to choose quality players in case of some injuries, actual decrease of player's performance etc. Football in developed countries has usually more registered football clubs, as well as the players (this also depends on the size of the country). Even though this input uses number of players, the correlation coefficient between inputs PLAYERS and PLRTIME is only 0.164, i.e. not significant (Table **5**). If we consider all mentioned aspects, input PLRTIME is suitable for the DEA model. This input must be considered as a negative input. The more minutes a player played in a national team the higher performance a national team had to exert. These players faced a higher workload than players with lower minutes. Regarding the DEA methodology, the inputs have minimization characters; therefore, PLRTIME must be a negative input.
- The third input MATCHES refers to a number of played matches during the 2014 FIFA World Cup qualification (Table **2**). The number of played matches differs according to the FIFA zone and also according to the national teams' performance. For example Uruguay had to play more matches than other qualified national teams from CONMEBOL zone. This happened due to the necessity to play intercontinental play-off match with Jordan. Similarly in case of Mexican national team that played intercontinental play-off against New Zealand. The correlation coefficient between the inputs MATCHES and PLRTIME is 0.725 (Table **5**). The time per a match is not always the regular 90 minutes. Matches differ according to the additional time that a referee added in each match. Moreover, the input PLRTIME is a ratio and also includes the number of players.

[2] The author understands the player quality as an indicator that reflects the market value of a player, the football league a player plays in, the team a player plays at. All these indicators are well known and used in many football votes and analyses. For example, the Castrol Performance Index (www.castrolfootball.com) is a ranking system that evaluates players' performance according to their individual statistics. Moreover, each European football league has assigned a difficulty coefficient representing their quality and prestigious (for example, coefficient 2.0 for leagues in England, Spain, Italy, Germany, 1.5 for Netherlands, France, Austria, Russia and 1.0 for Czech Republic, Estonia, Slovakia etc.). This coefficient is used for example in the European Golden Shoe competition addressed for the best scorer in the European football leagues. The last but not least, Transfermark (www.transfermarkt.com/) counts the market value of each player, leagues etc.

Table 2. Input/output structure of the DEA model.

Inputs	Outputs
Input 1: Number of used players (PLAYERS)	Output 1: Number of gained points (PTS)
Input 2: Ratio of minutes played par each player (PLRTIME)	Output 2: Difference in for and goals against (SCORE)
Input 3: Number of played matches (MATCHES)	
Input 4: Quality of the qualification group (GRPRANK)	

- The last input GPRRANK expresses the difficulty of each qualification group (Table **2**). This input requires a bit deeper explanation. In the football performance evaluation it is necessary to express the quality of opponent teams that each team, in our case qualified team, had to face. For example, if we consider the national team of Spain (the best ranked team according to the FIFA Ranking with 1871 points in June, 2011), then there was no better national team. Therefore, we can consider that Spain had easier opponents in its qualification group than, for example, Honduras (ranked 44th in June, 2011). Honduras played among others against Mexico (1007 points and 9th position in June, 2011) and USA (798 points and 25th position). Because the qualification spots took place from June 2011 until November 2013, the input GRPRANK must also consider FIFA Ranking changes in this period [18].

Therefore, GRPRANK includes ranking from June 2011 (when the qualification began), further from June 2012 (the middle of the qualification), and from November 2013 (when the qualification was over). Moreover, GRPRANK includes weighted average of all opponent teams according to the FIFA Ranking that qualified national team faced in the 2014 FIFA World Cup.

This enables us to capture the quality changes. Thus, better performance reached that national team, which faced teams with higher average qualities. GRPRANK as an input of the DEA model must be, similarly as PLRTIME, considered as a negative input. The more difficult a qualification group was the higher performance a national team had to exert to qualify to the 2014 FIFA World Cup.

The performance model has two outputs.

- The output PTS describes how many points each national team gained during the 2014 FIFA World Cup qualification. Due to the differences in each qualification zones, this output expresses a percentage of possible gained points (Table **2**). Therefore, we can compare all national teams without any distortion. Better performance was reached by that team, which was, according to its inputs, able to gain more points.
- The second output SCORE reflects the difference between goals for (number of goals that a national team scored) and goals against (number of goals opposite teams scored). As the first output, this output must consider the different number of played matches in each qualification zone. Therefore, the goals difference is calculated per a match (Table **2**). In this case, we are again able to compare, which team demonstrated higher performance with regard to attacking attributes. It is necessary to point out that attacking performance is related to a quality of players, as well as to opponent teams. Furthermore, attacking performance is also related to tactics, which each national team practices. Some teams, such as Argentina, the Netherlands and Spain, are well known as teams that prefer attacking tactics than the defensive one. On the other hand, teams such as Greece and Italy are both known from the history for their great defensive skills. However, the score is one of the most important factors in football (For example, the score is the second most important factor in the English Premier League. If two and more teams reach the same amount of points, then the score determines the position of each team.) and its usage is important.

The DEA model could also consist of the input describing the market price of the players (higher market price should lead to a higher performance). In this particular criterion, the problems of how to compare together the different qualification zones arise. The best ranked football leagues take place in Europe (especially English, French, German, Italian and Spanish leagues). From this reason, the highest market values have players from Europe and, consequently, a lot of money (from broadcasting, merchandizing etc.) is concentrated in these leagues. Therefore, players from the European leagues have in general higher market prices, although the quality of players can be comparable to those who do not play in Europe. Unfortunately, not all national teams have players directly from European leagues. For example, most of the teams from the AFC use players from domestic leagues. Therefore, it would be problematic to use market price as a criteria in the DEA model.

Similarly, the Gross Domestic Product (GDP) could be considered as an indicator for the DEA model. In this case a similar problem with comparison of analyzed teams arises. The GDP does not secure a great performance in sport, although it is often discussed as one of the most important criteria [24, 25]. A number of football clubs and registered football players mostly depend on the history and popularity of football in each country. In addition, huge differences between qualification zones exist (especially the UEFA and the CAF).

Table 3. Data summary for performance analysis, 2014 FIFA World Cup qualification.

DMU	Players	Plrtime	Matches	GRPRANK	PTS	Score
Algeria	30.000	265.233	8.000	437.583	0.750	1.125
Argentina	44.000	358.500	16.000	746.417	0.667	1.250
Australia	33.000	419.424	14.000	412.095	0.667	0.929
Belgium	22.000	453.045	10.000	651.667	0.867	1.400
Bosnia-Herzegovina	24.000	412.500	10.000	524.867	0.833	2.400
Cameroon	31.000	256.065	8.000	451.833	0.708	0.625
Colombia	35.000	450.114	16.000	776.542	0.625	0.875
Costa Rica	40.000	396.550	16.000	650.208	0.583	0.938
Côte d'Ivoire	29.000	273.138	8.000	390.417	0.750	1.500
Croatia	27.000	441.037	12.000	565.944	0.583	0.417
Ecuador	33.000	482.788	16.000	802.625	0.521	0.250
England	32.000	309.313	10.000	440.533	0.733	2.700
France	31.000	319.355	10.000	742.533	0.667	1.000
Germany	24.000	412.875	10.000	509.067	0.933	2.600
Ghana	31.000	253.387	8.000	398.833	0.750	2.375
Greece	31.000	384.097	12.000	503.722	0.806	0.833
Honduras	36.000	440.000	16.000	618.250	0.542	0.625
Chile	38.000	414.789	16.000	770.458	0.583	0.250
Iran	38.000	417.579	16.000	331.000	0.708	1.438
Italy	40.000	246.475	10.000	573.600	0.733	1.000
Japan	28.000	494.964	14.000	417.286	0.643	1.571
Korea Republic	45.000	308.600	14.000	353.000	0.643	1.143
Mexico	42.000	408.429	18.000	581.259	0.648	0.944
Netherlands	36.000	275.417	10.000	495.400	0.933	2.900
Nigeria	33.000	240.455	8.000	269.500	0.750	0.875
Portugal	29.000	408.862	12.000	555.111	0.750	1.083
Russia	26.000	383.615	10.000	523.933	0.733	1.500
Spain	28.000	282.857	8.000	581.833	0.833	1.375
Switzerland	27.000	369.519	10.000	548.533	0.800	1.100
Uruguay	29.000	616.034	18.000	713.889	0.537	0.278
USA	37.000	429.243	16.000	559.375	0.729	0.750

Table 4. Selected descriptive statistics of inputs and outputs.

	Players	Plrtime	Matches	GRPRANK	PTS	Score
Minimum	22.000	240.455	8.000	269.500	0.521	0.250
Maximum	45.000	616.034	18.000	802.625	0.933	2.900

Table 4. contd…

	Players	Plrtime	Matches	GRPRANK	PTS	Score
Mean	32.548	374.976	12.258	545.075	0.710	1.227
Standard deviation	5.830	87.062	3.321	137.515	0.106	0.699
Coefficient of variation	17.912	23.218	27.094	25.229	14.962	56.946

Table 5. Correlation coefficients for inputs and outputs.

	Players	Plrtime	Matches	GRPRANK	PTS	Score
PLAYERS	1.000	-0.164*	0.549	0.085*	-0.425	-0.249*
PLRTIME		1.000	0.725	0.478	-0.448	-0.350
MATCHES			1.000	0.470	-0.682	-0.478
GRPRANK				1.000	-0.396	-0.411
PTS					1.000	0.715
SCORE						1.000

* These correlation coefficients are not statistically significant ($\alpha=0.05$).

The structure of the DEA model for qualification performance analysis is shown in Table **2**. The DEA model consists of some indicators that are commonly used in football performance analysis, such as PLAYERS, MATCHES, PTS, and SCORE. On the other hand, the model brings completely new indicators such as PLRTIME and GRPRANK.

The author would like to increase the discrimination ability of the DEA models. Therefore, a set of three weight restrictions is incorporated into the DEA models. The author chose AR (assurance region) constraints according to Thomson *et al.* [26]:

$$L_{ij} \le \left(v_i / v_j\right) \le U_{ij} \quad (4)$$

where L_{ij} is the lower bound assigned to the ratio of variables i and j, U_{ij} is the upper bound assigned to the ratio of variables i and j, v_i is the weight for the variable i, and v_j is the weight for the variable j.

The AR constraints are set as $0.5 \le$ (PLAYERS/MATCHES ≤ 2, $0.5 \le \left(GRPRANK / PLRTIME\right) \le 2$, and $0.5 \le (PTS / SCORE) \le 2$. In this case, no higher preference for any input or output is assigned. All inputs or outputs in each pair can be preferred maximal by twice compare to the other input or output. As a consequence of the AR constraints, the discrimination ability of the DEA model increases. Furthermore, the AR constraints also enable to eliminate zero weights for some inputs or outputs, i.e. undesirable elimination.

Table **3** is a summary of all the data that are used for the performance analysis. There are no common indicators among inputs and outputs that would characterize teams from each 2014 FIFA World Cup qualification zones. For example teams in the UEFA zone played approximately 10 qualification matches (except those who played play-off round and Spain, the group of which consisted of fewer teams). On the other hand, the number of used players in the UEFA zone differs team by team from 22 (Belgium) to 40 (Italy). We can observe similar situation in the other zones. Further, no common characteristics in all zones are observable in regard to the score. Scores differ team by team and zone, because team strategy and quality played the main role here.

Table **4** presents a summary of descriptive statistics for inputs and outputs for 31 national teams qualified to the 2014 FIFA World Cup in Brazil. Minimum, maximum, mean, standard deviation and coefficient of variation are reported for each indicator. As shown, the typical qualified national team used 32.548 players with 374.976 minutes per a player, played 12.258 matches, and was included in a group with an average rank of opponent teams 545.075 points. Moreover, qualified team gained in average 71% of possible points, and the difference between the goals for and the goals against was 1.227 per a match. The coefficient of variation (CV) implies the high variability for the output SCORE (56.946). The other inputs and output vary from 14.962 (PTS) to 27.094 (MATCHES).

During the input/output description the author pointed out to problems with the correlation that would occur. Therefore, Table **5** consists of calculated correlation coefficients for all inputs and outputs. We cannot observe a higher correlation coefficient than 0.725 (between PLRTIME and MATCHES). Moreover, most of the coefficients vary between 0.24 and 0.55. Therefore, the input/output structure of the DEA model is appropriate.

Subsets of the inputs or outputs are often correlated. Then, it is tempting to omit such correlated variables in order

Table 6. Summary statistics of performance analysis.

	CCR Performance	BCC Performance	Scale Efficiency
Minimum	35.395%	41.289%	69.471%
Maximum	100.000%	100.000%	100.000%
Mean	67.242%	70.971%	94.002%
Standard deviation	0.208	0.196	0.064
Share of teams with performance of 100%	12.903%	19.355%	12.903%

to increase discrimination [27]. However, existence of high correlation among variables does not necessarily mean that one of them can be excluded without changing the subsequent DEA results [28]. In some cases, omission of highly correlated variable can lead to significant changes in efficiencies. From this reason, Dyson *et al.* [27] do recommend omission of highly correlated variables except if one variable is simply a multiple of the other. In our case, input PLRTIME is not a simple multiple of the input MATCHES. The author shows the effect of the input PLRTIME omission in the sensitivity analysis in the section Discussion (model 3 in Table **9**).

RESULTS

This part of the article provides a detailed explanation of the achieved results. The author used the output-oriented DEA model with constant returns to scale (CCR model), and variable returns to scale (BCC model). Output-orientation was used due to the main objective of the paper, i.e. to calculate the performance of the national football teams in the 2014 FIFA World Cup qualification. The author chose constant returns to scale as the main DEA model, according to the data specification. FIFA World Cup qualification was divided into 6 zones (AFC, CAF, CONCACAF, CONMEBOL, OFC, and UEFA); therefore, all the qualified teams could not influence those teams from the other zones. In addition, those teams in the same zones were, in the most cases, drawn into different qualification groups. In this case, each national team could not directly influence with its performance the other teams. Variable returns to scale are calculated for the purpose of the scale efficiency. The author also provides the information of benchmark units (using CCR model). Benchmark units describe peer units´ combination for those teams, which performance are lower than 100%.

According to the CCR DEA model, only four national teams reached the performance of 100% (Table **7**): Belgium, Colombia, Germany and Uruguay. This means that only 12.903% of qualified teams reached this performance (Table **6**). National team of Bosnia-Herzegovina (95.271%) and Ecuador (98.634%) are both close to the performance of 100%. On the other hand, the lowest CCR performance scores reached Korea Republic (35.395%), Croatia (40.557%), Cameroon (42.791%), Australia (43.902%) and Honduras (45.504%). The average CCR performance during the 2014 FIFA World Cup qualification was 67.242% (Table **6**).

Regarding the BCC DEA model now, two more national teams reached the performance of 100% (Table **7**). Ecuador, who is classified with the highest inefficient performance in CCR model, reached the performance of 100% now. The other team with the performance of 100% is the Netherlands. In addition, 19.335% of the national teams reached the performance of 100% now (Table **6**). The performance score of the Netherlands is 90.475% in the CCR model, even lower than in the case of Bosnia-Herzegovina. The average BCC performance increased to 70.971%. The variable returns to scale also influenced the lowest performance that increase from 35.395% in CCR model (Korea Republic) to 41.289% (Croatia) in the BCC model. Minimum and maximum values of the performance score show a high variability among the national teams. The scale efficiency 94.002% indicates that the average national team is 6% scale inefficient (Table **6**).

Table **8** provides information of the average input/output structures for those teams that have the performance 100%, to those "in the middle" with performance from 99.9% to 60%, and to those who reached the performance 59.9% and less. Teams that with the lowest performance gained significantly less points (68.9%) and their score difference is only 0.865. These outputs together with a lot of used players in the qualification (35.333) and group difficulty GRPRANK (508.863) caused their low performance score. Two other groups have no significant differences in either inputs or outputs. We can observe the main difference in quality of opponent teams (GRPRANK). The middle group has the average GRPRANK 556.165 compared to 662.791 for those teams with the performance of 100%. Moreover, middle group used more players (30.273 compared to 27.500), but on the other hand, played fewer games in the 2014 FIFA World Cup qualification. Even though the teams in the middle group played against easier opponents (considering GRPRANK indicator), they did not have better results (PTS). On the other hand, due to the easier opponent teams, the score of the middle group is higher (1.547) than the teams with the performance of 100% have (1.288).

Asian Football Confederation (AFC)

No team from the AFC reached the performance of 100%, neither in the CCR model nor in the BCC model. In the AFC zone, Japan has the highest performance (67.889%), but it is still too far from 100% performance (Table **7**). The other national teams performed much worse (Australia 43.902%, Iran 49.734%, and Korea Republic 35.395%). This lower CCR performance can be explained

Table 7. Performance results for qualified national teams, 2014 FIFA World Cup.

DMU	CCR	BCC	Scale Efficiency	Benchmarks CCR
Algeria	56.213%	58.118%	96.723%	Germany (1.0455)
Argentina	89.047%	94.059%	94.671%	Colombia (1.0105) Germany (0.1885)
Australia	43.902%	49.670%	88.388%	Germany (1.0934) Uruguay (0.1983)
Belgium	100.000%	100.000%	100.000%	14
Bosnia-Herzegovina	95.271%	95.467%	99.794%	Colombia (0.0316) Germany (0.9518)
Cameroon	42.791%	44.954%	95.189%	Germany (1.0682)
Colombia	100.000%	100.000%	100.000%	9
Costa Rica	55.431%	62.286%	88.994%	Belgium (0.7144) Colombia (0.5121) Germany (0.0872) Uruguay (0.0592)
Côte d'Ivoire	65.672%	66.790%	98.325%	Germany (1.0227)
Croatia	40.557%	41.289%	98.226%	Belgium (0.3634) Germany (0.5693) Uruguay (0.1644)
Ecuador	98.634%	100.000%	98.634%	Colombia (0.6163)
England	84.615%	93.878%	90.134%	Germany (1.1818)
France	77.945%	79.431%	98.129%	Belgium (0.7639) Colombia (0.2823)
Germany	100.000%	100.000%	100.000%	23
Ghana	83.950%	87.533%	95.907%	Germany (1.0682)
Greece	49.630%	53.937%	92.015%	Belgium (0.4558) Germany (0.7747) Uruguay (0.0272)
Honduras	45.504%	49.360%	92.189%	Belgium (1.0158) Colombia (0.0606) Uruguay (0.3273)
Chile	58.401%	61.080%	95.613%	Belgium (0.1142) Colombia (0.9732)
Iran	49.734%	61.486%	80.888%	Germany (1.2059) Uruguay (0.2606)
Italy	48.273%	54.396%	88.744%	Belgium (0.8680) Germany (0.5351)
Japan	67.889%	69.726%	97.366%	Germany (0.8627) Uruguay (0.2627)
Korea Republic	35.395%	50.949%	69.471%	Belgium (0.0349) Germany (1.4822) Uruguay (0.0972)
Mexico	50.469%	57.544%	87.705%	Belgium (1.2072) Colombia (0.0410) Germany (0.0168) Uruguay (0.3663)
Netherlands	90.475%	100.000%	90.475%	Colombia (0.0522) Germany (1.1932)
Nigeria	47.746%	51.724%	92.309%	Germany (1.1136)
Portugal	59.736%	62.913%	94.951%	Belgium (0.6714) Germany (0.4801) Uruguay (0.0566)
Russia	65.533%	66.447%	98.625%	Belgium (0.1263) Germany (0.9249)
Spain	69.034%	69.080%	99.933%	Belgium (0.0536) Germany (0.9488)
Switzerland	61.073%	62.485%	97.742%	Belgium (0.3099) Germany (0.7723)
Uruguay	100.000%	100.000%	100.000%	11
USA	51.589%	55.511%	92.935%	Belgium (0.6997) Germany (0.3560) Uruguay (0.3684)

Note: bold text refers to teams with the performance of 100% in either CCR model or BCC model.

Table 8. Average structures of teams according to their performance.

Average	Players	Plrtime	Matches	GRPRANK	PTS	Score
Performance 100%	27.500	483.017	13.500	662.791	0.741	1.288
Performance 99.9% - 60%	30.273	358.176	10.909	556.165	0.721	1.547
Performance 59.9% and less	35.333	365.123	13.067	508.863	0.679	0.865

due to the low average quality of the opponent teams in the 2014 FIFA World Cup qualification. The average quality was 222.133 points compared to 907.7 points in CONMEBOL and 638.519 in UEFA zones (Table **10**). The other explanation relates to a number of players that Australia, Iran and Korea Republic used in the qualification. Australia needed 33 players, Iran 38 players, while Korea Republic needed 45 players (the most from all the teams qualified to Brazil and above the average 32.548 (Table **4**), and also compared to 28 players in case of Japan[3]. On the other hand, more players did not lead to higher outputs (gained points and a better score) compared to Japan, as well as compared to the teams from the other zones.

Moreover, the low performance of AFC teams is in general caused by their outputs level. Percentages of possible gain points vary around 65% (Australia 66.7%, Japan and Korea Republic both with 64.3%), while Iran gained 70.8% points. These results lay under the qualification average 71% for the PTS output. For example, all teams from the CAF zone (except Cameroon with 70.8%) gained 75% of the points, and many teams from the UEFA zone gained over 80% of the points. Nevertheless, many teams exist with a better score difference. Although Iran with 1.438 and Japan with 1.571 lay above the SCORE average 1.227 (Table **4**), it is not enough for a better performance score due to their inputs structures.

Confederation of African Football (CAF)

All qualified national teams from CAF zone reached the performance lower than 85% (Table **7**). Ghana, as the best evaluated CAF team, has a performance 83.950%. All CAF teams have similar input structures. CAF teams had the shortest qualification with only 8 games (All the national teams that qualified from the CAF zone did not participate in the round 1 of the CAF qualification [6].). Spain was the only other team who played only 8 games in the 2014 FIFA World Cup qualification. Moreover, most of the African teams used a similar number of players that lay below the qualification average 32.548 players per a team. GRPRANK was the only significant difference between the African teams. According to the FIFA Ranking, Nigeria faced the easiest average opponents (269.5), whereas Cameroon faced the most difficult ones (451.833). The most difficult GRPRANK in case of Cameroon could be the main reason, why Cameroon gained only 70.8% possible points (still better or equal than the AFC teams). Together with the lowest score difference 0.625, Cameroon reached the lowest performance in the CAF zone.

The other teams gained identically 75% of points; therefore, the differences lay in the SCORE output. Ghana as the best team from CAF zone with the performance 83.950%, has significantly higher score difference (2.375). Côte d'Ivoire as the second best team has the score difference 1.5, Algeria 1.125 and Nigeria has only 0.875. Considering the 2014 FIFA World Cup qualification average 1.227 (Table **4**), only Ghana and Côte d'Ivoire had better scores than average. All African national teams (except Ghana) have lower performance than the average performance 67.242%. One of the main reasons why the teams in the CAF zone did not reach 100% performance is the average quality of teams in African zones. GRPRANK 354.148 is almost twice smaller than the average in UEFA (638.519) and almost 2.5 times smaller than in CONMEBOL (907.7).

Confederation of North, Central American and Caribbean Association Football (CONCACAF)

Similarly, like in the AFC zone, no team from the CONCACAF reached the performance of 100%. Team Costa Rica reached the best performance 64.683%, while Honduras has the performance 45.504%, Mexico 50.469%, and USA 51.589% (Table **7**) all lay under the average CCR performance 67.242% (Table **6**). One of the main reasons could be a low GRPRANK 275.2 of the CONCACAF zone, which is even worse compared to the CAF zone. Nevertheless, all four qualified teams faced strong opponent teams with GRPRANK between 551.259 and 650.2084. Therefore, number of used players influenced the performance of these teams. All CONCACAF teams needed at least 36 players during the whole qualification.

Moreover, the other reasons of the low performances are outputs (that all, except PTS in case of USA, lay significantly below the 2014 FIFA World Cup qualification average (Table **4**). Costa Rica, Honduras and Mexico gained only between 54.2% and 64.8% points. Mexico finished the qualification at the 4th place; therefore, its higher PTS percentage is related to two victories during the intercontinental play-off matches against New Zealand. This intercontinental play-off also influenced Mexican score (aggregated score 8-3); otherwise, it would be even lower.

[3] Number of players cannot be explained by the length of the qualification. Teams in the AFC zone did not play the most matches in the qualification. Teams from the CONMEBOL played more matches (Uruguay even played two matches more due to the intercontinental play-off against Jordan), teams from the CONCACAF played the same amount of matches (Mexico, similarly as Uruguay, played 2 more matches in the intercontinental play-off against New Zealand). Only teams from the CAF and the UEFA played fewer matches.

[4] The reason why the final GRPRANK for qualified teams is much higher than the average of CONCACAF zone is the qualification format. National teams with very low FIFA Ranking evaluation were eliminated in the first two rounds of the qualification. Then the best 12 teams of the CONCACAF zone (including all qualified teams to the 2014 FIFA World Cup) played in the round 3, or round 4 respectively [5].

South American Football Confederation (CONMEBOL)

South American zone is, in contrast to AFC, CAF and CONCACAF, characterized by high overall performance. Colombia and Uruguay reached the CCR performance of 100%, while Ecuador (98.634%) is the best assessed team below the performance of 100% (Table **7**). Ecuador, similarly as the Netherlands in the UEFA zone, has the performance of 100% in the BCC model. Higher performance definitely relates to the highest GRPRANKs. For example Ecuador with GRPRANK 802.625 faced the most difficult opponent teams (Colombia 2nd and Chile 3rd) in the 2014 FIFA World Cup qualification. Although all CONMEBOL teams needed a lot of players in the qualification, PLRTIME is not the lowest compared to the other zones (number of the played matches is also high). Moreover, the GRPRANK influenced the output PTS, so all South American teams gained only between 52.1% and 66.7% points (all lay below the qualification average). GRPRANK has a similar effect to the output SCORE. Except Argentina (1.25), all teams lay below the qualification average (Table **4**).

If we consider low output structures of CONMEBOL teams, the main influence for the high performance must have inputs. Author pointed out in Table 10 that this zone is the most difficult one. Moreover, we must also remind that Brazil did not participate in the 2014 FIFA World Cup qualification because Brazil is the host country. Brazil was ranked as the 10th best team with 1102 points (FIFA Ranking, November, 2013). Apart of the opponents' ranking, input PLRTIME also positively influenced the performance results of CONMEBOL teams.

Union of European Football Associations (UEFA)

Similarly as in the CONMEBOL zone, two teams from the UEFA zone (Belgium and Germany) reached the CCR performance of 100%. Furthermore, many other teams reached performance close to 100% (Table **7**). High number of well performed teams is, among others, influenced with 13 allocated teams to the 2014 FIFA World Cup. On the other hand, the quality of the European teams is also high (average 638.519 points, with 6 teams in the top 10 of the FIFA Ranking).

One of the reasons of the high performance is the output SCORE. Many teams lay significantly above the qualification average (Netherlands 2.9, England 2.7, Germany 2.6 and Bosnia-Herzegovina 2.4). Along with the high score evaluation, all the teams (except Croatia and France) lay above the average in the output PTS (Table **4**). On the other hand, great output structure is also supported by the inputs. For example, Belgium needed only 22 players (Bosnia-Herzegovina and Germany 24 players) during the qualification, which resulted to a high PLRTIME evaluation. Most of the teams from the UEFA zone lay below the PLAYERS average (except Italy and Netherlands). Another reason of the high performance is the number of played matches.

An interesting thing is that the best ranked national team Spain (according to the FIFA ranking) did not reach the performance of 100% or closer. Spain performance is only 69.034% in the CCR model and 69.080% in the BCC model (Table **7**). Considering the quality of Spain, the SCORE output is only 1.375. This result is still above the qualification average 1.227, but many lower ranked teams have better score.

DISCUSSION

Sensitivity Analysis and Model Robustness

The author used Data envelopment analysis for assessing a performance of the 31 qualified teams to the 2014 FIFA World Cup in Brazil. The DEA model consists of 4 inputs and 2 outputs. It is always essential to choose the right inputs and outputs, which should describe any specific model. Sensitivity analysis is a method used to determine the degree of sensitivity to data variations in any particular application of the DEA (i.e. provide stability). Many approaches, how to provide the sensitivity analysis, exist [19]. The basic approaches for the sensitivity analysis are: 1) some DMUs are deleted or added to the data set, or 2) number of inputs and outputs decreases or increases.

To provide the sensitivity analysis, the author calculates another two DEA models with different inputs/outputs structures (Table **9**). The author decided to decrease the number of inputs instead of the number of DMUs (the main objective of assessing the qualified teams still remains). In this case, the discrimination ability of the DEA model increases[5]. Model 1 is the initial CCR DEA model discussed in the previous section. On the other hand, model 2 does not consist of input PLAYERS. This input is still partly included in the input PLRTIME. The rest of the model has the same structure and a set of AR constraints (except $0.5 \leq$ (PLAYERS/MAT-CHES) ≤ 2,) are as in the model 1. Results of the model 2 are similar as for the model 1. The average CCR performance increases from 67.242% to 70.851% (for the BCC model from 70.971% to 74.476%). This increase by approximately 3.5% for the CCR model caused the performance of 100% for Ghana and Netherlands. Ecuador, similarly as in the BCC model 1, reached the BCC performance of 100%. In addition, Australia, Croatia, Honduras and Korea Republic remain between the teams with the lowest performance. Spain is the team that increased its performance the most significantly (from approximately 69% in the model 1 to 79.728% (CCR) and 100% (BCC)). This difference could mean, that the low performance of Spain mainly depended on the input PLAYERS. Even though, we can observe a few differences, model 2 confirms the results of model 1.

Model 3 increases the discrimination ability by removing the input PLRTIME. This input caused the highest correlation 0.725 with the other input MATCHES. As in model 2, the rest of the model has the same structure and set

[5] Cooper *et al.* [19] propose the number of chosen DMUs as $n \geq \max\left\{m \times s; 3\left(m+s\right)\right\}$, where n= number of DMUs, m = number of inputs and *s*=number of outputs. Dyson et al. [27] proposes the number of chosen DMUs as $n \geq 2 \times m \times s$. Therefore, if we decrease the number of inputs (*m*), the discrimination ability of the DEA model arises.

Table 9. Sensitivity analysis, performance results within different DEA models.

	Model 1		Model 2		Model 3	
DMU	**CCR**	**BCC**	**CCR**	**BCC**	**CCR**	**BCC**
Algeria	56.213%	58.118%	67.980%	71.723%	56.213%	58.118%
Argentina	89.047%	94.059%	91.715%	94.059%	97.255%	100.000%
Australia	43.902%	49.670%	44.101%	49.670%	37.466%	47.703%
Belgium	100.000%	100.000%	100.000%	100.000%	100.000%	100.000%
Bosnia-Herzegovina	95.271%	95.467%	95.291%	95.535%	95.859%	95.930%
Cameroon	42.791%	44.954%	52.913%	55.998%	42.791%	44.954%
Colombia	100.000%	100.000%	100.000%	100.000%	100.000%	100.000%
Costa Rica	55.431%	62.286%	55.727%	62.286%	52.388%	61.523%
Côte d'Ivoire	65.672%	66.790%	77.533%	79.619%	65.672%	66.790%
Croatia	40.557%	41.289%	40.684%	41.289%	37.122%	39.536%
Ecuador	98.634%	100.000%	98.634%	100.000%	100.000%	100.000%
England	84.615%	93.878%	91.454%	91.454%	84.615%	93.878%
France	77.945%	79.431%	81.292%	100.000%	100.000%	100.000%
Germany	100.000%	100.000%	100.000%	100.000%	100.000%	100.000%
Ghana	83.950%	87.533%	100.000%	100.000%	83.950%	87.533%
Greece	49.630%	53.937%	50.178%	53.937%	49.027%	52.770%
Honduras	45.504%	49.360%	45.839%	49.360%	39.778%	46.589%
Chile	58.401%	61.080%	59.399%	61.080%	61.426%	63.884%
Iran	49.734%	61.486%	50.035%	61.486%	40.284%	59.878%
Italy	48.273%	54.396%	54.396%	54.396%	53.747%	60.705%
Japan	67.889%	69.726%	67.728%	69.726%	53.000%	61.888%
Korea Republic	35.395%	50.949%	38.305%	50.949%	34.314%	50.949%
Mexico	50.469%	57.544%	50.964%	57.544%	44.146%	55.742%
Netherlands	90.475%	100.000%	100.000%	100.000%	99.759%	100.000%
Nigeria	47.746%	51.724%	61.290%	61.290%	47.746%	51.724%
Portugal	59.736%	62.913%	60.053%	62.913%	58.046%	62.504%
Russia	65.533%	66.447%	66.447%	66.447%	67.081%	68.045%
Spain	69.034%	69.080%	79.728%	100.000%	79.414%	80.019%
Switzerland	61.073%	62.485%	62.487%	62.487%	63.525%	65.069%
Uruguay	100.000%	100.000%	100.000%	100.000%	48.418%	50.413%
USA	51.589%	55.511%	52.210%	55.511%	43.443%	52.452%
Average	67.242%	70.971%	70.851%	74.476%	65.693%	70.277%

Note: bold text refers to teams with the performance of 100% in either CCR model or BCC model.

Table 10. Descriptive statistics of federations' quality, FIFA ranking, November 2013.

	AFC	CAF	CONCACAF	CONMEBOL	OFC	UEFA
Min	0.000	6.000	0.000	519.000	5.000	0.000
Max	650.000	918.000	1019.000	1251.000	378.000	1507.000
Mean	222.133	354.148	275.200	907.900	100.636	638.519
SD	166.754	237.197	270.452	265.454	113.389	342.945

of AR constraints, in this case except $0.5 \leq (GRPRANK / PLRTIME) \leq 2$). The average CCR perform-ance decreases by 1.55% (from 67.242% to 65.693%), while the average BCC performance decreases only by 0.694% (from 70.971% to 70.277%). In either the CCR model or the BCC model, the set of teams with the performance of 100% changes dramatically. Belgium, Colombia, Ecuador, France and Germany are the teams with the highest performance. For the BCC model another two teams (Argentina and Netherlands) belong to this group of teams. The performance of Uruguay dropped down significantly from 100% to 48.418% (CCR model). The performance of Uruguay depends mostly on the negative input PLRTIME, which is for Uruguay the highest from all the assessed national teams. Without this input the indicators are not perfect and cause a low performance.

The sensitivity analysis indicates a high stability of the constructed DEA model. Even though some inputs were excluded from the model, the set of teams with the performance of 100% remained very steady. This stability also depends on the set of constraints, which eliminate high one-side input or output weight preferences. In a few cases, the sensitivity analysis discovered high dependences between a team performance and an input. For example Uruguay, which performance mainly depends on the input PLRTIME (see model 3 in Table **9**). Nevertheless, the stability of the model shows right input and output choose.

Factors Influencing and Explaining the Performance Results

The performance results are directly influenced by the quality of the qualification zones, i.e. the quality of the opponent teams. If we consider the FIFA ranking [18] as a tool for comparing quality between football teams, then we can observe differences between zones (Table **10**). The highest average 907.9 points reached CONMEBOL, followed by UEFA with 638.519 points. Therefore, even though AFC (46 members) and the CAF (53) both have very similar number of members as the UEFA (54), both federations have only 4.5, 5.0 respectively, spots in the FIFA World Cup. CONMEBOL federation has only 10 members (11 with Brazil), so 4.5 spots are sufficient.

According to the current official FIFA ranking (November, 2013) the highest ranked team of AFC is Iran (45^{th}), then Japan (48^{th}), Korea Republic (54^{th}), Australia (59^{th}), and Uzbekistan (68^{th}). The average points of Asian teams in the FIFA Ranking are 222.133 points (Bhutan has no points and Macau has 10 points). The highest ranked CAF team is Côte d'Ivoire (17^{th}). Other teams ranked in top 40 are Ghana (24^{th}), Algeria (26^{th}), Nigeria (36^{th}), Egypt (38^{th}) and Cape Verde Islands (39^{th}). The average points of African teams in the FIFA Ranking are 354.148 points (Djibouti has 8 points and Somalia 6).

The average points of CONCACAF teams are 275.2 points (Anguilla has 3 points and Turks and Caicos Islands have any points). The highest ranked team is USA (14^{th}), other teams in top 40 are Mexico (20^{th}), Costa Rica (31^{st}), and Panama (37^{th}). On the other side, Argentina (3^{rd}), Colombia (4^{th}), Uruguay (6^{th}), Brazil (10^{th}) from CONMEBOL zone are all ranked in the top 10. The lowest ranked team is Bolivia (69^{th}), nevertheless has still more points than the AFC, CAF, CONCACAF and OFC average points. Thus, the CONMEBOL zone is one of the most difficult qualifications considering the FIFA ranking. As consequence, the high performance scored of Colombia, Ecuador, and Uruguay is influenced by the GRPRANK input. The OFC have the lowest average points 100.636, and the highest ranked team is New Zealand (91^{st}).

According to the current official FIFA ranking (November 2013), there are six European teams in the top 10, including the best team of the last couple of years Spain. Spain won two last UEFA EURO Cups in 2008 and 2012, along with the victory of 2010 FIFA World Cup in South Africa. The other countries are Germany (2^{nd}), Portugal (5^{th}), Italy (7^{th}), Switzerland (8^{th}) and Netherlands (9^{th}). The average points of European teams in the FIFA Ranking are 638.519 points (San Marino has no points, Andorra 17 and Gibraltar is not yet included).

Besides the teams´ quality, the performance in football is also influenced by many other variables. For example, very important is the impact of altitude on performance [29]. From this reason, CONMEBOL is also specified, among some others, by its geographic location that is different to other zones. For example, National stadium in Lima, Peru (Estadio Nacional) is 1550 meters above the sea level, Estadio Olímpico Atahualpa in Quito, Ecuador (2800), Estadio Hernando Siles in La Paz, Bolivia (3640). During football matches, players might have breathing problems in altitudes higher than 2500 meters above the sea level. Furthermore, there are many other criterions influencing performance, such as travel effects, special tactics, and psychological aspects. All of these aspects relate to the home advantage in football [30]. Moreover, football results also depend on collective offensive and defensive behaviour of each team [31].

The achieved results provide information about the qualification period. Thus, we cannot say that the teams with the highest performance would win the 2014 FIFA World Cup. The 2014 FIFA World Cup is played in a different time, weather conditions, and also in a different area, than most of the qualification matches were played. However, the results can be used as a basis for such conclusions or predictions. The results can also be useful for coaches, as they have direct and indirect effects on team performances. Direct effects are related to a strategy (combination of available players and choose of tactics), while the indirect effects are related to coach´s leadership (influencing the performance through players´ motivation). Feltz *et al.* [32] summarized factors influencing coaching efficacy as game strategy, motivation, technique, and character building. Dawson *et al.* [33] found out that coaching efficiency is only partly correlated with team performance. However, coaches may use the achieved result for improving above mentioned factors. In addition, coaches´ experiences can influence attacking performance of a team [33], which would lead for improving outputs PTS and SCORE.

CONCLUSION

This article focuses on the national football teams' performance in the 2014 FIFA World Cup qualification to Brazil. For this analysis, the author uses approach of the Data envelopment analysis. The DEA model contains of four inputs describing the qualification group and used players of each national teams. The outputs of the DEA model describe the score, expressing the difference between the goals for and the goals against, along with the percentage of the gained points of each team. The results show the highest performance for Belgium, Colombia, Germany and Uruguay under the constant and variable returns to scale. Teams such as Argentina, Bosnia-Herzegovina, Ecuador, and the Netherlands show higher performances very close to the performance of 100%.

These achieved results do not guarantee a success at the final tournament. As the sport always shows, many variables directly and indirectly influence the current teams' performance. The article only provides information about the qualification period. All qualified teams will have similar conditions during the 2014 FIFA World Cup. Thus, specifics of the qualification zones will be eliminated and actual players´ forms and teams´ tactics will play the main role. Nevertheless, the results could predicate teams´ forms, i.e. the distribution of quality before the final tournament. Furthermore, the results could also justify the allocation of qualification spots among the qualification zones. The future research would lead to a long-time analysis in the international football. Also some predictions towards the 2018 FIFA World Cup qualification, based on this current research, would be provided.

CONFLICT OF INTEREST

Declared none.

ACKNOWLEDGEMENTS

Declared none.

REFERENCES

[1] FIFA. Contribution pool for FIFA World Cup participants up by 37 per cent. Fédération Internationale de Football Association (FIFA). 2013. [cited 2014 March 10] Available from: http://www.fifa.com/worldcup/media/newsid=2239443/

[2] FIFA. 2014 FIFA World Cup Brazil - Regulations. Fédération Internationale de Football Association (FIFA). 2011. [cited 2013 December 4]. Available from: http://www.fifa.com/mm/document/tournament/competition/01/47/38/17/regulationsfwcbrazil2014_en.pdf

[3] AFC. FIFA World Cup Brazil - Preliminary Competition Format and Draw Procedures. Asian Football Confederation (AFC). 2011. [cited 2013 December 4]. Available from: http://www.fifa.com/mm/document/tournament/competition/01/44/46/14/2014fwc_drawprocedures_asia_en.pdf

[4] CAF. 2014 FIFA World Cup Brazil - Preliminary Competition Format and Draw Procedures. Confederation of African Football (CAF). 2011. [cited 2013 December 4]. Available from: http://www.fifa.com/mm/document/tournament/competition/01/44/46/05/2014fwc_drawprocedures_africa_en.pdf

[5] CONCACAF. 2014 FIFA World Cup Brazil - Preliminary Competition Format and Draw Procedures. Confederation of North, Central American and Caribbean Association Football (CONCACAF). 2011. [cited 2013 December 4]. Available from: http://www.fifa.com/mm/document/tournament/competition/01/49/68/86/2014fwc_drawprocedures_northcentralamericacaribbean_en.pdf

[6] CONMEBOL. 2014 FIFA World Cup Brazil - Preliminary Competition Format and Draw Procedures. South American Football Confederation (CONMEBOL). 2011. [cited 2013 December 4]. Available from: http://www.fifa.com/mm/document/tournament/competition/01/46/87/56/2014fwc_drawprocedures_southamerica_en.pdf

[7] OFC. 2014 FIFA World Cup Brazil - Preliminary Competition Format and Draw Procedures. Oceania Football Confederation (OFC). 2011. [cited 2013 December 4]. Available from: http://www.fifa.com/mm/document/tournament/competition/01/44/46/41/2014fwc_drawprocedures_oceania_en.pdf

[8] UEFA. 2014 FIFA World Cup Brazil - Preliminary Competition Format and Draw Procedures. Union of European Football Associations (UEFA). 2011. [cited 2013 December 6]. Available from: http://www.fifa.com/mm/document/tournament/competition/01/44/46/23/2014fwc_drawprocedures_europe_en.pdf

[9] Collier T, Johnson AL, Ruggiero J. Measuring technical efficiency in Sports. J Sport Econs 2011; 12 (6): 579-598. http://dx.doi.org/10.1177/1527002510391582

[10] Carmichael F, Thomas D, Ward D. Team performance: the case of English premiership football. Manag Dec Econs 2000; 21 (1): 31-45. http://dx.doi.org/10.1002/1099-1468(200001/02)21:1<31::AID-MDE963>3.3.CO;2-H

[11] Barros CP, Garcia-del-Barrio P. Efficiency measurement of the English football Premier League with a random frontier model. Econo Modell 2008; 25: 994-1002. http://dx.doi.org/10.1016/j.econmod.2008.01.004

[12] García-Sánchez IM. Efficiency and effectiveness of Spanish footbal teams: a three-stage-DEA approach. Cent Euro J Oper Res 2007; 15 (1): 21-45. http://dx.doi.org/10.1007/s10100-006-0017-4

[13] Tiedemann T, Francksen T, Latacz-Lohmann U. Assessing the performance of German Bundesliga football players: a non-parametric metafrontier approach. Cent Euro J Oper Res 2011; 19 (4): 571-87. http://dx.doi.org/10.1007/s10100-010-0146-7

[14] Boscá JE, Liern V, Martínez A, Sala R. Increasing offensive or defensive efficiency? An analysis of Italian and Spanish football. 2009; 37: 63-78. http://dx.doi.org/10.1016/j.omega.2006.08.002

[15] Barros CP, Leach S. Performance evaluation of the English Premier Football League with data envelopment analysis. Appl Econs 2006; 38 (12): 1449-58. http://dx.doi.org/10.1080/00036840500396574

[16] Haas DJ. Technical efficiency in the Major League Soccer. J Sport Econs 2003; 4 (3): 203-15. http://dx.doi.org/10.1177/15-27002503252144

[17] Saumik, P, Ronita, M. How to predictable are the FIFA worldcup football outcomes? An emperical analysis. Appl Econs Lett 2008; 15 (15): 1171-6. http://dx.doi.org/10.1080/13504850601007117

[18] FIFA. FIFA/Coca-Cola World Ranking Procedure. Fédération Internationale de Football Association (FIFA). 2014. [cited 2014 April 10]. Available from: http://www.fifa.com/worldranking/rankingtable/index.html?intcmp=fifacom_hp_module_associations

[19] Cooper WW, Seiford LM, Zhu J. Handbook on Data Envelopment Analysis. International Series in Operations Research & Management Science; 164. Springer, 2nd edition 2011. http://dx.doi.org/10.1007/978-1-4419-6151-8

[20] Charnes A, Cooper WW, Rhodes E. Measuring the efficiency of decision making units. Euro J Oper Res 1978; 2 (6): 429-44. http://dx.doi.org/10.1016/0377-2217(78)90138-8

[21] Banker R, Charnes A, Cooper WW. Some models for estimating technical and scale inneficiencies in data envelopment analysis. Manag Sci 1984; 30: 1078-92.

[22] Färe R, Grosskopf S, Logan J. The relative efficiency of Illinois public utilities. Resour Energy 1983; 5 (4): 349-67.

[23] Scheel H. EMS: Efficiency Measurement System. 2000. [cited 2013 February 10]. Available from: http://www.holger-scheel.de/ems/.

[24] Lozano S, Villa G, Guerrero F, Cortés P. Measuring the performance of nations at the Summer Olympics using data envelopment analysis. J Oper Res Soc 2002; 53 (5): 501-1. http://dx.doi.org/10.1057/palgrave/jors/2601327

[25] Bernard AB, Busse MR. Who wins the Olympic games: Economic resources and medal totals. Rev Econs Stats 2004; 86 (2): 413-7. http://dx.doi.org/10.1162/003465304774201824

[26] Thomson RG, Singleton FD, Thrall RM, Smith BA. Comparative site evaluation for locating a high-energy physics lab in Texas. Interfaces 1986; 16: 35-49.

[27] Dyson RG, Allen R, Camanho AS, Podinovski VV, Sarrico CS, Shale EA. Pitfalls and protocols in DEA. Euro J Oper Res 2001; 132 (2): 245-59. http://dx.doi.org/10.1016/S0377-2217(00)00149-1

[28] Nunamaker, TR. Using data envelopment analysis to measure the efficiency of non-profit organisations: A critical evaluation. Manag Dec Econs 1985; 6 (1): 50-8.

[29] McSharry. Altitude and athletic performance: statistical analysis using footbal results. BMJ 2008; 335: 1278-81. http://dx.doi.org/10.1136/bmj.39393.451516.AD

[30] Pollard R. Home advantage in football: A current review of an unsolved puzzle. Open Sports Sci J 2008; 1: 12-14.

[31] Vilar L, Araújo D, Davids K, Bar-Yam, Y. Science of winning soccer: Emergent pattern-forming dynamics in association football. J Sys Sci Complex 2013; 26 (1). http://dx.doi.org/10.1007/s11424-013-2286-z

[32] Feltz DL, Chase MA, Moritz SE, Sullivan PJ. A conceptual model of coaching efficacy: Preliminary investigation and instrument development. J Educ Psychol 1999; 91 (4): 765-76.

[33] Dawson P, Dobson S, Gerrard B. Estimating coaching efficiency in professional team sports: Evidence from English association football. Scott J Pol Econ 2000; 47 (4): 399-412.

Received: May 23, 2014 Revised: October 12, 2014 Accepted: October 22, 2014